What is claimed is:

1. A pressure-modulation apparatus, comprising:

an electrode array system comprising at least two electrodes; and

a conduit interconnecting said electrodes, wherein said conduit contains an electrically conductive fluid in contact with a phase positioned in a pressure chamber.

2. The apparatus of claim 1, further comprising at least one reservoir in communication with the conduit to contain materials transported by the conduit.

3. The apparatus of claim 2, wherein said reservoir is positioned in the pressure chamber.

4. The apparatus of claim 1, wherein said conduit comprises an electrically non-conducting tube.

5. The apparatus of claim 1, further comprising a pressure-transmitting apparatus to transmit pressure to or from the pressure chamber.

6. The apparatus of claim 1, comprising at least three electrodes.

7. The apparatus of claim 6, wherein said electrodes defined at least two axes.

8. A method for purifying nucleic acids from a sample, said method comprising:

contacting the sample with the phase of the apparatus of claim 1 at an initial pressure, wherein said phase non-specifically binds to nucleic acids with greater affinity than said phase binds to non-nucleic acid components of the sample;

transporting at least some of the non-nucleic acid components towards one of said electrodes;

modifying the pressure to a level sufficient to disrupt the binding of the nucleic acids to the phase; and

transporting the nucleic acids towards a second of said electrodes.

9. The apparatus of claim 1, wherein said conduit comprises an electrophoretic capillary.

10. A method for purifying nucleic acids from a sample, said method comprising:

contacting the sample with the phase of the apparatus of claim 9 at an initial pressure, wherein said phase non-specifically binds to nucleic acids with greater affinity than said phase binds to non-nucleic acid components of the sample;

electrophoretically separating at least some of the non-nucleic acid components from the nucleic acids;

modifying the pressure to a level sufficient to disrupt the binding of the nucleic acids to the phase; and

electrophoretically separating the nucleic acids from the phase at the modified pressure.

11. The apparatus of claim 1, wherein said conduit comprises an electroosmotic capillary.

12. A method for purifying nucleic acids from a sample, said method comprising:

contacting the sample with the phase of the apparatus of claim 11 at an initial pressure, wherein said phase non-specifically binds to nucleic acids with

greater affinity than said phase binds to non-nucleic acid components of the sample;

electroosmotically separating at least some of the non-nucleic acid components from the nucleic acids;

modifying the pressure to a level sufficient to disrupt the binding of the nucleic acids to the phase; and

electroosmotically separating the nucleic acids from the phase at the modified pressure.

13. The apparatus of claim 1, wherein said electrode array system is configured on a microchip.

14. The apparatus of claim 1, wherein said phase comprises hydroxyapatite.

15. The apparatus of claim 1, wherein said phase comprises an immobilized nucleic acid molecule.

16. The apparatus of claim 1, wherein said phase comprises silica.

17. The apparatus of claim 1, wherein said phase comprises an anion-exchange resin.

18. A method for isolating and purifying nucleic acids from a sample, said method comprising:

applying the sample to a phase at an initial pressure, wherein said phase non-specifically binds to nucleic acids with greater affinity than said phase binds to non-nucleic acid components of the sample;

spatially separating at least some of the non-nucleic acid components from the phase and the nucleic acids;

modifying the pressure to a level sufficient to disrupt the binding of at least some of the nucleic acids to the phase; and

spatially separating the nucleic acids from the phase at the modified pressure,

wherein the applying and first spatially separating steps are carried out within a single reaction vessel.

19. The method of claim 18, wherein the first spatially separating step comprises transporting non-nucleic acid components into a reservoir.

20. The method of claim 19, wherein the reservoir contains a binding material.

21. The method of claim 18, wherein the first spatially separating step comprises electrophoresis.

22. The method of claim 18, wherein the first spatially separating step comprises electroosmosis.

23. The method of claim 18, wherein said initial pressure is ambient pressure and said modified pressure is an elevated pressure.

24. The method of claim 23, wherein said elevated pressure is 500 to 100,000 psi.

25. The method of claim 18, wherein the sample comprises cells and said method further comprises subjecting said sample to a hyperbaric pressure sufficient to lyse the cells.

26. The method of claim 25, wherein the cells comprise external and nuclear membranes, and the hyperbaric pressure is sufficient to lyse the external membrane, but insufficient to lyse the nuclear membranes.

27. The method of claim 18, wherein the sample comprises nucleic acid-binding proteins and said method further comprises subjecting said sample to a hyperbaric pressure sufficient to inactivate the nucleic acid-binding proteins.

28. The method of claim 27, wherein the nucleic acid-binding proteins comprise nuclease enzymes.

29. The method of claim 18, wherein the sample comprises various sizes of nucleic acids, the modified pressure level is sufficient only to disrupt the binding of relatively small nucleic acids to the phase, and the method further comprises:

further modifying the pressure to a level sufficient to disrupt the binding of relatively larger nucleic acids to the phase; and

spatially separating the nucleic acids from the phase at the further modified pressure.

30. The method of claim 25, wherein said sample comprises a biological fluid.

31. The method of claim 25, wherein said sample comprises whole blood.

32. The method of claim 25, wherein said sample comprises serum or plasma.

33. The method of claim 25, wherein said sample comprises cultured cells.

34. The method of claim 25, wherein said sample comprises tumor biopsy tissue.

35. The method of claim 25, wherein said sample comprises plant tissue.

36. The method of claim 25, wherein said sample comprises living tissue.

37. The method of claim 18, wherein said nucleic acids comprise DNA.

38. The method of claim 18, wherein said nucleic acids comprise total RNA.

39. The method of claim 18, wherein said nucleic acids comprise messenger RNA (mRNA).

40. The method of claim 18, wherein said nucleic acids comprise viral RNA.

41. The method of claim 37, wherein said DNA is chromosomal DNA.

42. The method of claim 37, wherein said DNA comprises a vector.

43. The method of claim 37, wherein said DNA comprises viral DNA.

44. The method of claim 18, wherein said modified pressure is sufficient to elute vector DNA but not high enough to elute chromosomal DNA.

45. The method of claim 18, wherein said modified pressure is sufficient to elute RNA but not high enough to elute chromosomal DNA.

46. The method of claim 18, wherein said method further comprises adding a dicarbonyl compound to the sample to inactivate nucleic-acid binding proteins.

47. The method of claim 18, wherein said phase comprises hydroxyapatite.

48. The method of claim 18, wherein said phase comprises an immobilized nucleic acid molecule.

49. The method of claim 18, wherein said phase comprises silica.

50. The method of claim 18, wherein said phase comprises an anion-exchange resin.

51. The method of claim 18, wherein said phase comprises a pressure-sensitive gel.

52. The method of claim 18, wherein said phase comprises a pressure-stable medium.

53. The method of claim 52, wherein said medium is a non-porous resin comprising 1 to 50 μm beads having a positively charged surface.

54. The method of claim 18, further comprising concentrating the nucleic acids between two membranes by electrophoresis, wherein one of said membranes is substantially impermeable to nucleic acids and the second membrane has increased permeability to nucleic acids under applied electrical potential.

55. The method of claim 54, wherein said concentration is carried out at said modified pressure.

56. The method of claim 18, further comprising trapping the spatially separated nucleic acids in a filter by electrophoresis.

57. The method of claim 18, further comprising transporting the spatially separated nucleic acids to an analytical device.

58. The method of claim 57, wherein said analytical device is a matrix-assisted laser desorption and ionization (MALDI) mass spectrometer.

59. A device for carrying out the method of claim 18, the device comprising:

a pressure modulation apparatus; and

a pressurizable cell containing said phase, wherein said cell is adapted to fit within said apparatus.

60. A device for pressurizing a sample, the device comprising:

a sample compartment; and

a pressure-transmitting apparatus to transmit pressure from a pressurizing medium outside of said

device to the sample compartment, without allowing fluid flow between the medium and the sample compartment.

61. The device of claim 60, further comprising a chamber having an orifice, wherein said sample compartment and pressure-transmitting apparatus are configured within said orifice.

62. The device of claim 60, wherein said pressure-transmitting device comprises a shape-memory alloy device.

63. The device of claim 60, wherein said pressure-transmitting apparatus comprises a magnetostrictive device.

64. The device of claim 61, wherein said chamber comprises a cylinder and said pressure-transmitting apparatus comprises a piston.

65. The device of claim 64, wherein said cylinder comprises a plastic tube having a sealed end and an open end, and said piston comprises a rubber piston.

66. The device of claim 60, wherein said chamber comprises a well in a microtiter plate.

67. A method for permeabilizing cells, the method comprising:

charging the sample compartment of the device of claim 60 with cells at an initial pressure;

introducing the device into a pressure modulation apparatus; and

momentarily increasing the pressure to at least 10,000 psi to permeabilize the cells.

68. The method of claim 67, wherein said sample compartment is also charged with a gas.

69. The method of claim 67, further comprising applying a voltage across the sample compartment to spatially separate at least some components of the permeabilized cells from other components of the cells.

70. The method of claim 67, further comprising freezing the cells.

71. An improved ion-exchange chromatography method, the improvement comprising using hyperbaric pressure to modulate binding affinities associated with an ion-exchange material.

72. A method for the isolation of molecules from cells, the method comprising:

exposing the cells to an elevated pressure of at least 500 psi in a pressure chamber to form lysed cells; and

separating the molecules from the lysed cells within the pressure chamber.

73. The method of claim 72, further comprising cycling the pressure between the elevated pressure and ambient pressure at least twice.

74. The method of claim 72, wherein the molecules are extracted by elution with a flowing solvent, electrophoresis, electroosmosis, selective absorption to an absorptive medium, filtration, differential sedimentation, volatilization, distillation, gas chromatography, or precipitation.

75. The method of claim 72, wherein the pressure is raised to its final value in less than 1 second.

76. The method of claim 72, wherein the pressure is raised to its final value in less than 0.1 second.

77. The method of claim 72, wherein the molecules are extracted while the cells are at said elevated pressure.

78. The method of claim 72, further comprising returning the cells to ambient pressure.

79. The method of claim 72, further comprising purifying the molecules, at least partially, within the pressure chamber.

80. The method of claim 79, wherein the molecules are purified by elution with a flowing solvent, electrophoresis, electroosmosis, selective absorption to an absorptive medium, filtration, differential sedimentation, volatilization, distillation, gas chromatography, or precipitation.

81. The method of claim 79, wherein the purifying step requires a change in pressure of at least 500 psi.

82. The method of claim 72, wherein the cells are selected from the group consisting of yeast, bacteria, fungi, animal cells, plant cells, insect cells, and protozoan cells.

83. The method of claim 78, wherein the cells are returned to ambient pressure in 1 second or less.

84. The method of claim 78, wherein the cells are returned to ambient pressure in 0.1 second or less.

85. A method of lysing a cell, the method comprising:

providing a frozen cell under atmospheric pressure;

while maintaining the cell at a subzero temperature, exposing the cell to an elevated pressure in a pressure chamber, the elevated pressure being sufficient to thaw the frozen cell at the subzero temperature;

depressurizing the pressure chamber to freeze the cell at the subzero temperature; and

repeating the exposing and depressurizing steps until the cell is lysed.

86. The method of claim 85, wherein the subzero temperature is about -20°C or higher, and the elevated pressure is between about 28 psi and 75,000 psi.

87. The method of claim 85, wherein the pressure is raised to its final value in less than 10 second.

88. The method of claim 85, wherein the pressure is raised to its final value in less than 1 second.

89. The method of claim 85, wherein the cell is a bacterium, a fungal cell, a plant cell, an animal cell, an insect cell, and a protozoan cell.

90. The method of claim 85, wherein the cell is a yeast cell.

91. A method of isolating a biological component from a liquid sample, the method comprising:

exposing the sample to an elevated pressure in a pressure chamber, the elevated pressure being sufficient to maintain the sample in a liquid state at a subzero temperature;

while maintaining the elevated pressure, reducing the temperature of the sample to the subzero temperature; and

while maintaining the elevated pressure and the subzero temperature, isolating the biological component from the sample.

92. The method of claim 91, wherein the subzero temperature is about -20°C or higher, and the elevated pressure is between about 28 psi and 75,000 psi.

93. A pressure-modulation apparatus, comprising:

an electrode array system comprising at least two electrodes;

a conduit interconnecting said electrodes, wherein said conduit contains an electrically conductive fluid in contact with a phase positioned in a pressure chamber; and

means for controlling temperature of the pressure chamber.

94. The pressure-modulation apparatus of claim 93, further comprising at least one reservoir in communication with the conduit to contain materials transported by the conduit.

95. A method for purifying nucleic acids from a liquid sample, said method comprising:

contacting the sample with the phase of the apparatus of claim 93 at an initial pressure, wherein said phase non-specifically binds to nucleic acids with greater affinity than said phase binds to non-nucleic acid components of the sample;

transporting at least some of the non-nucleic acid components towards one of said electrodes;

modifying the pressure to a level sufficient to disrupt the binding of the nucleic acids to the phase; and

transporting the nucleic acids towards a second of said electrodes,

wherein the initial pressure or the modified pressure or both are sufficiently high to maintain the sample at a liquid state at a subzero temperature.

96. The method of claim 95, wherein the nucleic acids are RNA.

97. The method of claim 96, wherein the modified pressure is sufficient to elute RNA but not high enough to elute chromosomal DNA.

98. A method for the isolation of molecules from cells, the method comprising:

exposing the cells to a temperature of at least 45°C and a pressure of at least 500 psi in a pressure chamber to form lysed cells; and

separating the molecules from the lysed cells within the pressure chamber.

99. The method of claim 98, wherein the temperature is in the range of about 50°C to about 90°C.

100. A method for disruption of cells or tissue, ~~or inactivation of microbes,~~ the method comprising:

freezing the sample; and

pulsating the pressure while maintaining the sample in the frozen state, thereby disrupting the cells, tissue, or microbes.

101. A method for inactivating proteins in a sample, the method comprising:

adding to the sample one or more reagents selected from the group consisting of ~~isothiocyanates~~, 1,2- and 1,3-dicarbonyl compounds, maleimides, succinimides, sulfonyl chlorides, aldehydes, ninhydrin, ortho-phthalaldehyde, iodoacetamide, β-mercaptoethanol, and cross-linking agent, to form a reaction mixture; and

pressurizing the reaction mixture, thereby inactivating the proteins.

102. The method of claim 101, wherein the proteins are ~~ribonuclease~~ enzymes.